

Kentucky Geological Survey

228 Mining & Mineral
Resources Bldg.
University of Kentucky
Lexington, KY
40506-0107
859.257.5500
fax 859.257.1147
www.uky.edu/KGS

James Cobb, State
Geologist and
Director
John Kiefer, Assistant
State Geologist
Carol Ruthven, Editor,
Kentucky Geology

Our mission is to
increase knowledge and
understanding of the
mineral, energy, and
water resources,
geologic hazards, and
geology of Kentucky for
the benefit of the
Commonwealth and
Nation.

In this issue

KGS Online Data Search Services	1
KGS Oil and Gas Mapping Service Attracts Interest	1
Helping Citizens Learn about Karst in Kentucky	1
Director's Desk	2
Renewed Funding for KGS Digital Geologic Mapping	2
In Focus: Assessing Earthquake Hazards and Risk	Insert
Spotlight on New Publications	3
AIPG Spring Meeting	3
Calendar of Events	4
KGS Annual Seminar	4

New enhancements

KGS online data search services

KGS has added data on
springs to its online data-
searching services. The
springs data are available from
the same page on which you
search for water-well data,
[kgsweb.uky.edu/
DataSearching/Water/
WaterWellSearch.asp](http://kgsweb.uky.edu/DataSearching/Water/WaterWellSearch.asp). Two
search buttons on this page
allow you to search either the
water wells or the springs
database. Once your results
come up, you can click on a
link to search the other
database, using the same
criteria.

Another new enhance-
ment is the ability to download
records from water well, oil
and gas, coal borehole, or coal

thickness searches as text-
delimited files. You can also
choose the datum and projec-
tion for your downloaded data
through use of a pop-up box.
The default is the NAD-27
datum and decimal degree
projection.

If you're interested in
information about samples
stored at the KGS **Well Sample
and Core Library**, check out
our Web site. If a well has a
sample available, a "Sample
Report" link will appear under
the formation information in
the search-results table.
Clicking on this link will
display basic header informa-
tion for both the well and for
samples available for that well.

Lithologic and coal-seam
data from more than 9,000
borehole locations have been
added to the coal-borehole
searching facility. This updated
service is available at
[kgsweb.uky.edu/DataSearching/
Coal/Borehole/
boreholesearch.asp](http://kgsweb.uky.edu/DataSearching/Coal/Borehole/boreholesearch.asp). For more
information about the data
provided with this service, please
go to [kgsweb.uky.edu/
DataSearching/Coal/Borehole/
aboutBoreholes.asp](http://kgsweb.uky.edu/DataSearching/Coal/Borehole/aboutBoreholes.asp).

For more information on
these new online services, or to
provide us feedback, contact
Doug Curl at 859.257.5500 ext.
140 or send Doug e-mail at
dcurl@kgs.mm.uky.edu. ❖

"Kentucky Is Karst Country!"

Helping citizens learn about karst in Kentucky

Did you know that the
beautiful rolling hills of
the Inner Bluegrass and the
Western Pennyroyal Regions
are the result of development
of karst landscape? The beauty
of the landscape conceals
problems, however, which
negatively affect many
Kentuckians.

If you're planning to
build a home, or drill a well to
find water on your property, or
want to learn more about
Kentucky's landscape, you
should read a new publication
by KGS hydrogeologist and
karst expert **Jim Currens**,
"Kentucky Is Karst Country!"

(continued on page 2)



Karst is what makes the rolling hills of the Bluegrass. Photo by
Deanna Davis.

KGS oil and gas mapping service attracts interest

The Kentucky Geological
Survey's oil and gas
mapping service, available on
the Kentucky Geography
Network's Web site, is one of
the two most popular sites on
the network, according to the
February 2003 issue of
Techlines, the online technol-
ogy news service for the
Commonwealth of Kentucky
([www.techlines.ky.gov/
kgm.htm](http://www.techlines.ky.gov/kgm.htm)). ❖

**Don't forget:
KGS annual seminar,
May 16, 2003—details
on page 4**

Director's Desk



For the past two decades, we have had an active earthquake research program in Kentucky. KGS and the UK Department of Geological Sciences jointly operate the Kentucky Seismic and Strong-Motion Network, one of the largest seismic networks in the eastern United States. The recently installed 850-foot-deep seismometer at Sassafras Ridge in Fulton County is the deepest seismometer east of the Rockies.

Our seismic network monitors earthquakes in Kentucky, the United States, and abroad. Data collected about the location of epicenters, depth, and magnitude of earthquakes helps define faults deep in the earth where the earthquakes originate. Six strong-motion stations collect engineering data on ground motion; these data must be taken into account when bridges, dams, highways, municipal and commercial buildings, and homes are constructed.

Earthquakes are hazardous to human health and safety, as well as property. A recurrence of the magnitude of the 1811–1812 New Madrid, Mo.,

earthquakes would have a major impact on Kentucky. We want to know where and when earthquakes capable of causing damage in Kentucky can occur, and communicate the risks to citizens so they can be prepared and damage can be minimized.

Predicting the exact time, location, and magnitude of earthquakes isn't possible. But statistics can be used to estimate the probability of an earthquake of a given magnitude over a specified period.

Our goal is to communicate the results of seismic research to the public and to State and Federal agencies responsible for building codes, hazard predictions, and public safety. Current recordings of earthquakes from 10 of the 12 stations in the statewide network are available free on the KGS Web site at www.uky.edu/kgs.

People who refer to earthquake studies and data must understand the science behind the research, and scientists must understand how their research influences public policy.



Reliable earthquake research is essential in order to protect public health and safety, while at the same time not exaggerating the risks of hazards, which can lead to unnecessarily strict building standards. We are proud of our earthquake research and our scientific collaboration with the UK Department of Geological Sciences. This has been and will continue to be a great benefit to the Commonwealth. ❖

James C. Ceb

(Karst in Kentucky, continued from page 1)

What You Should Know about Sinkholes and Springs."

The term "karst" is derived from a Slavic word meaning "barren, stony ground." Although a karst landscape most commonly develops on limestone, it can also develop on several other types of rocks. Most of the karst in Kentucky is on limestone and formed over hundreds of thousands of years. Thousands of Kentucky households receive their drinking water from supplies of groundwater originating from springs and wells in karst areas, and many major cities, including Frankfort, Louisville, Lexington, Georgetown, and Bowling Green, are in karst areas.

Communities are often developed near karst springs to take advantage of reliable water sources, but subsequent development can pollute the springs. Ultimately, the springs may have to be abandoned and alternative water supplies found. Houses and factories built over filled sinkholes may be

damaged when the fill is transported out of the sinkhole and the surface over the sinkhole collapses. Structures built in sinkholes are also vulnerable to flood damage.

Currens's publication offers color photos of karst features, explanations of how water flows underground, and a description of some of the geologic

hazards associated with building on karst landscape. The publication includes advice for citizens to help minimize financial losses from karst hazards. For more information, contact Currens at 859.257.5500, ext. 160 or by e-mail at currens@kgs.mm.uky.edu. The publication is available to download at no charge on the KGS Web site at www.uky.edu/KGS/pubs/lop.htm. ❖

Renewed funding for KGS Digital Geologic Mapping Program

The Kentucky Geological Survey received a 1-year, \$224,358 grant from the U.S. Geological Survey (USGS) for digital compilation of geologic maps. This funding will be used to focus on completion of the Campsville and Morehead 30 x 60 minute, 1:100,000-scale maps. This is the eighth consecutive year of funding from the USGS. This Digital Geologic Mapping Program has generated more than \$1.3 million in extramural funding for KGS. Staff scientists are using these

funds to create a comprehensive set of digital maps and databases of geologic information.

This information is important for the long-term growth and development of the Commonwealth, and it will be accessible from a Web site and Internet map server. For more information contact **Warren Anderson**, Principal Investigator for the Digital Geologic Mapping Program, at 859.257.5500 ext. 151 or by e-mail at wanderson@kgs.mm.uky.edu. ❖

John D. Kiefer and Carol L. Ruthven
April 2003

Why study earthquakes?

Although for many people earthquakes may seem “out of sight, out of mind,” they should not be ignored. Earthquakes have caused extensive damage and loss of life in the United States and abroad. Homeowners, businesses, emergency-response planners, structural and construction engineers, and government officials need scientifically sound assessments of earthquake hazards and risk. These assessments are used to establish design specifications for earthquake-resistant buildings and bridges and rates for insurance premiums.

In California, many faults are at or near the surface, earthquakes are frequent, and there are many data for researchers to assess. In contrast, in the central United States, faults are deeper, earthquakes are less frequent, and there are fewer data. Earthquakes in California have been studied for almost 100 years using thousands of elaborate instruments. Extensive study of earthquakes in the central United States has been more recent, but a great deal of knowledge has been acquired in the last 20 years, and it has important implications for Kentucky.

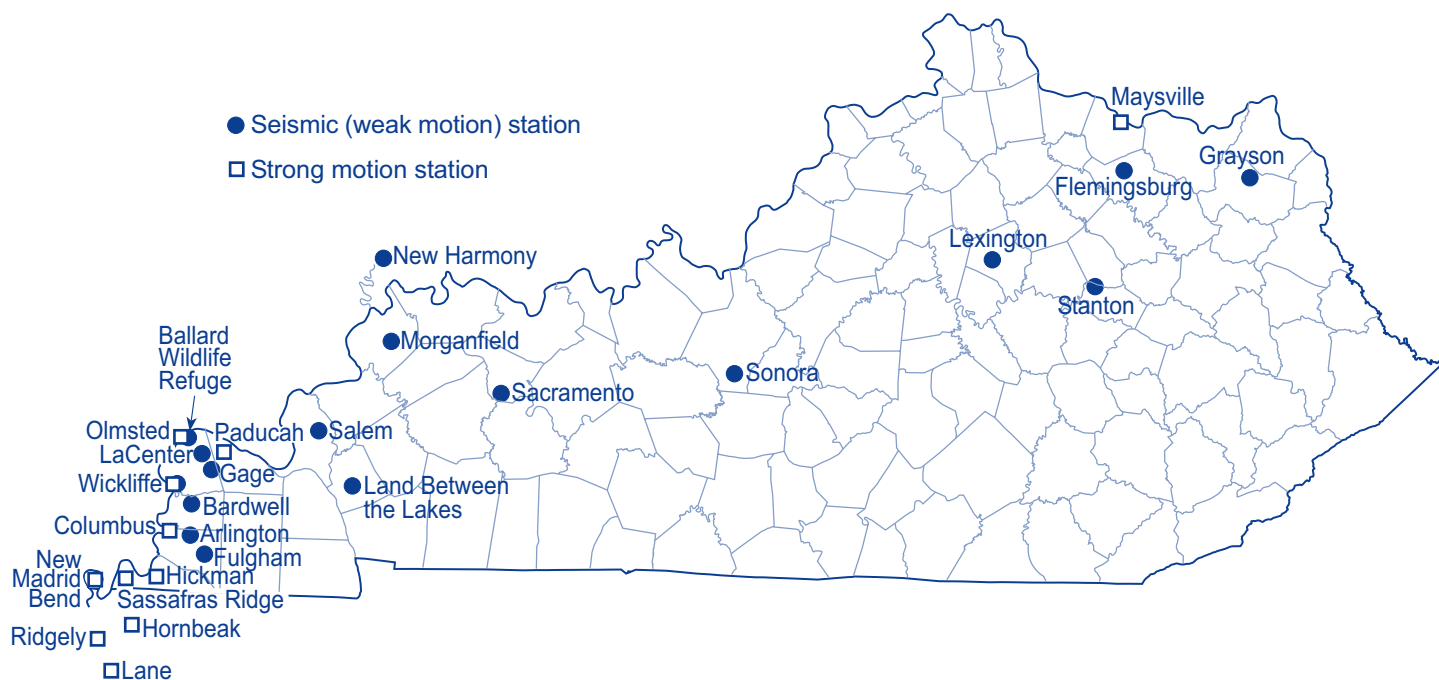
Earthquake research in Kentucky

The Kentucky Geological Survey (KGS), in cooperation with the University of Kentucky (UK) Department of Geological Sciences, has been at the forefront of earthquake research in Kentucky. A key objective has been to provide information to public and private decision-makers preparing for infrequent but high-impact earthquakes. Western Kentucky and the New Madrid Seismic Zone, and more recently the Wabash Valley Seismic Zone, are the focus of this research.

A wealth of data has been acquired from the Kentucky Seismic and Strong-Motion Network, established in late 1980 and jointly operated by the Department of Geological Sciences and KGS. The network has 21 stations that can monitor any earthquake occurring in or around Kentucky with a magnitude greater than 2.0, as well as major earthquakes in the central United States and many

around the world. The strong-motion network is designed to record ground motion from strong earthquakes in the New Madrid Seismic Zone, which stretches from just west of Memphis, Tenn., into southern Illinois. The Kentucky strong-motion network is the largest in the United States outside of California, and we have just installed seismometers at Sassafras Ridge, in Fulton County, Ky., to a depth of 850 feet. This is the deepest seismometer east of the Rocky Mountains.

Since March 2002, near real-time seismic records for 10 stations across the state are available on the KGS Web site at www.uky.edu/KGS/geologichazards/geologichazards.html. This online access to data is valuable to researchers, as well as the general public. Its value became apparent as hundreds of people visited the site at the time of the magnitude-5.0 earthquake on June 18, 2002, whose epicenter was in the Evansville, Ind.–Henderson, Ky., area. The site was very popular again when a magnitude-2.9 earthquake struck on January 3, 2003; its epicenter was in New Haven, about



30 miles west of Henderson, Ky., and 25 miles northeast of Harrisburg, Ill.

Challenges in research

Geologists who study earthquakes (geophysicists and seismologists) face a great challenge, because earthquakes happen infrequently and without any advance warning. This makes estimating earthquake hazards and risk difficult. The task is further complicated by engineering and economic factors that also need to be considered.

The earthquake effect that has the most impact is ground motion, caused by waves created by an abrupt movement of a fault. Ground motion is usually expressed as a percentage of the acceleration of gravity (g). One g is 32 feet per second squared. Imagine a building or a bridge accelerating at that rate, or even a fraction of 1 g. This is equivalent to accelerating your car from a dead stop for a distance of 100 meters in 3.2 seconds. A ground-motion acceleration of only a fraction of 1 g in the horizontal direction can cause buildings to separate from their foundations or collapse—somewhat analogous to rapidly pulling a carpet from underneath someone who is standing; that person will most likely fall (Pipkin and Trent, 2001).

Seismic hazard maps and construction

Seismic hazard maps published by the U.S. Geological Survey (USGS) predict ground motion for different locations in the nation. These maps are the basis for seismic design found in the Recommended Provisions of the National Earthquake Hazards Reduction Program, the International Building and Residential

Codes, and the American Society of Civil Engineers' national design load standard. The information on seismic-hazard maps is used by engineers and others in the design of residential and commercial buildings, bridges, highways, dams, and pipelines.

The information is important for safety reasons. It also has major implications for economic development. If the hazards are overestimated, unnecessarily stringent building standards may result, which increases construction costs and insurance premiums. This, in turn, can have a negative impact on economic development. Overestimation can be a deterrent to expansion or upgrading of existing facilities, as well as a deterrent to new businesses that might otherwise locate in a region. Underestimating hazards can pose safety problems, if communities are not adequately prepared to withstand the predicted impact of an earthquake. A balance based on sound science must be struck between safety and economic development.

The development of seismic hazard maps depends upon many factors, including the nature of the bedrock and soils. In the region of the New Madrid Seismic Zone, limestone and sandstone bedrock are covered by a thick blanket of unconsolidated sediments. The unconsolidated or loose sediments above the bedrock can amplify ground motion. Geologists can estimate the amplification that is expected.

The seismic hazard map currently used for seismic safety regulation shows the probabilistic ground motion with a 2 percent probability of being exceeded in 50 years. Produced by the USGS in 1996, the map predicts very

high ground motion in the Paducah area of western Kentucky, even higher than some places in California that are more seismically active. This has been the subject of considerable debate and discussion among seismologists. This subject was a hot topic at a recent workshop held in Lexington, November 18, 2002, to discuss maps for seismic hazard and design. The workshop abstracts are published in a new KGS publication, "The Kentucky NEHRP Seismic Hazard and Design Maps Workshop: Proceedings" compiled by Zhenming Wang. A PDF file of this publication is available on the KGS Web site at www.uky.edu/KGS/pubs/lop.htm.

Research collaboration for the Commonwealth

Geologists at KGS and the UK Department of Geological Sciences are working with the Kentucky Natural Resources and Environmental Protection Cabinet; Kentucky Department of Housing, Buildings, and Construction; State Building Commissioner; Structural Engineering Association of Kentucky; USGS; and others to develop a realistic seismic hazard map for western Kentucky based on sound science. For more information about this and other areas of seismic research, please visit the KGS Web site at www.uky.edu/kgs, or contact John Kiefer, Zhenming Wang, or Ed Woolery at 859.257.5500 or by e-mail at zwang@kgs.mm.uky.edu, kiefer@kgs.mm.uky.edu, or woolery@uky.edu.

Reference cited

Pipkin, B. W., and Trent, D. D., 2001, Geology and the environment [3d ed.]: Pacific Grove, Calif., Brooks/Cole, 569 p.

Spotlight on new publications

New water well and spring maps

KGS has published two new water well and spring maps by **Bart Davidson**: “Water Well and Spring Map of the Louisville 30 x 60 Minute Quadrangle, Kentucky” and “Water Well and Spring Map of the Falmouth, Cincinnati, and Madison 30 x 60 Minute Quadrangles, Kentucky.” Both maps, published at a scale of 1:100,000, show the locations of water wells and springs that the Kentucky Groundwater Data Repository indicates are in these quadrangles.

The maps, which will be of interest to environmental consultants, water planners, and property owners, are available for free on the KGS Web site at www.uky.edu/KGS/pubs/lop.htm. Previously published maps for the Lexington, Harrodsburg, Somerset, Bowling Green, Beaver Dam, and Campbellsville quadrangles are also available here. For more information, contact Davidson at 859.257.5500 ext. 162 or send him an e-mail message at bdavidson@kgs.mm.uky.edu. ❖

New water-supply reports for eastern Kentucky

Two new open-file reports by **Robert Andrews** describe the methods and results of a study to identify sources of groundwater for **Vest** and the surrounding area in **Knott County**, and **Oakdale** and the surrounding area in **Breathitt County**. Andrews used remote-sensing and inclined drilling techniques to locate high-yielding water wells (wells yielding

more than 30 gallons a minute). In addition to assessing the long-term stability of wells that were drilled, Andrews monitored the quality of water discharging from the production wells. These studies will be of interest to environmental consultants, water planners, and county officials. For more information, contact Andrews at 859.257.5500 ext. 159 or by e-mail at randrews@kgs.mm.uky.edu. ❖

An anthology of KGS publications

Would you like the convenience of having KGS publications on a single CD-ROM? If so, a new CD-ROM, “Selected Kentucky Geological Survey Publications 1999–2002,” by **Meg Smath**, **Terry Hounshell**, and **Steve Cordivola**, is for you. Priced at only \$5, this CD is an incredible value: the list price for all of these publications in printed format is almost \$300.

The CD-ROM contains PDF files of all KGS maps, charts, and reports published in the last 4 years that are available in electronic format. The PDF's may be viewed on most personal computers using the free copy of Acrobat Reader included on the CD-ROM. A searchable index to all the publications on the CD is also included. For more information, contact **Roger Banks** at 859.257.5500 ext. 126 or by e-mail at rbanks@kgs.mm.uky.edu. ❖

KGS annual report online

The KGS 2001–02 annual report is now available online at www.uky.edu/KGS/announce. If you would like to provide feedback on the content and organization of the report, you may submit it anonymously using the form found at www.uky.edu/KGS/announce/annualrptcritique.htm. Any feedback received is welcome and helpful in the design and preparation of future annual reports. ❖

New publication will aid geologists in interpreting geologic history

A new report by **Garland Dever** and **Jack Moody**, “Bronston and Burnside Members: Subdivision of the St. Louis Limestone in South-Central Kentucky,” will help geologists establish regional correlations and interpret the geologic history of Mississippian rocks in south-central and east-central Kentucky. Dever is an industrial minerals geologist with the Kentucky Geological Survey; Moody, formerly a Survey geologist, currently works with the Kentucky Division of Water.

Lithologic units in the St. Louis Limestone and lower part of the Slade Formation, both of Mississippian age, are defined and named in the report. The St. Louis consists of two major units, the Bronston and Burnside Members. The Ringgold Bed and Big Sinking Bed are widespread, extending across south-central and east-central Kentucky. For more information, contact Dever at 859.257.5500 ext. 134 or by e-mail at gdever@kgs.mm.uky.edu. ❖

AIPG spring meeting

The Kentucky Section of the American Institute of Professional Geologists (AIPG) will host its spring meeting on Saturday, May 10, 2003, at Mammoth Cave National Park. The meeting will include a public cave tour and a field trip to the proposed site of the Kentucky Trimodal Transpark. **Michael May**, Associate Professor of Geology, Western Kentucky University, will present the guest lecture “Earth System Science, Politics, and the Proposed Kentucky Trimodal Transpark near Mammoth Cave National Park.” For more information or to make reservations, please contact **Donnie Lumm** at 502.564.8334 or by e-mail at Donnie.Lumm@mail.state.ky.us. ❖

The Hydrologic Cycle

Carried by the sun,
the sea moves over the land,
washing and feeding
her lost children.

—by Dan Carey

KGS mailing list

Would you like to receive the KGS newsletter and announcements of meetings and new publications? Please call us at 859.257.5500 ext. 128 or send an e-mail message to **Carol Ruthven** at cruthven@kgs.mm.uky.edu—simply type

“Electronic-Mailing List Addition” in the subject line of your message, type your mailing address and phone and fax number in the message—and we will include your name and address in our mailing list. ❖

Calendar of events

- ♦ **May 10:** Kentucky Chapter of American Institute of Professional Geologists spring meeting, Mammoth Cave National Park, contact Donnie Lumm at 502.564.8334 or by e-mail at donnie.lumm@mail.state.ky.us
- ♦ **May 11–14:** American Association of Petroleum Geologists annual meeting, Salt Lake City, Utah, www.aapg.org/meetings/slc03/
- ♦ **May 16:** KGS 43rd annual seminar, KGS Well Sample and Core Library, Lexington, Ky.
- ♦ **September 6–10:** AAPG-SPE 2003 Eastern Meeting, Pittsburgh, Penn., www.aapg-spe-2003.org/
- ♦ **November 2–5:** Geological Society of America annual meeting, Seattle, Wash., www.geosociety.org/meetings/2003/ ❖

KGS annual seminar, May 16, 2003

For the last 7 years KGS has been engaged in an ambitious program to convert all of Kentucky’s 7.5-minute geologic quadrangle maps to digital format. As the program nears completion, a number of products are being prepared that have a variety of uses for both geological and nongeological users. A workshop will be offered at the KGS annual seminar, to be held at the Well Sample and Core Library, to discuss the process of data conversion and explain the differences among the various products. Attendees can find out how to obtain digital geologic map information and use it in a number of software products. This

workshop is intended for all those interested in using digital geologic maps in GIS applications.

The seminar will also feature keynote speaker **John Steinmetz**, State Geologist and Director of the Indiana Geological Survey. A summary of active research projects at KGS and numerous posters will be presented by various KGS staff. The program will be posted in the news and announcements section on the KGS Web site at www.uky.edu/kgs. For more information, contact **Carol Ruthven** at 859.257.5500 ext. 128 or by e-mail at cruthven@kgs.mm.uky.edu. ❖

Kentucky Geological Survey
228 Mining & Mineral Resources Bldg.
University of Kentucky
Lexington, KY 40506-0107

Address service requested

Nonprofit Organization U.S. Postage PAID Lexington, KY Permit No. 51
--